

**DUPLICATE**

10/532824

JC12R PCT/PTC 26 APR 2005

1/2007  
1

1    **Insect Repellent**

2

3    The present invention relates to an insect repellent.  
4    More particularly the present invention relates to a  
5    composition, which can be applied to the skin in order to  
6    repel insects including, but not limited to mosquitoes  
7    and midges.

8

9    In a number of European countries including the UK, and  
10   particularly Scotland, the midge and horsefly are serious  
11   irritants, to tourists, gardeners and sports enthusiasts,  
12   such as ramblers, hill-walkers, climbers, etc. It is  
13   estimated that around 14,000 species of midge exist, some  
14   of which carry viruses which are known to be dangerous to  
15   animals. Whilst in general, midge bites are not  
16   particularly dangerous and rarely result in disease in  
17   humans, the bites can be unpleasant and cause pruritis  
18   (itching), urticaria (skin eruptions) and localised  
19   inflammation. Unfortunately, it is thought that the  
20   prevalence of these pests may increase as worldwide  
21   climate changes occur.

22

1 The common midge and fly are irritating but generally  
2 harmless pests. However in many countries serious and  
3 potentially fatal diseases are spread by insects, such as  
4 mosquitoes. For example, the mosquito-borne illness,  
5 malaria, is one of the main killer diseases of the world,  
6 and causes an estimated 1 to 2 million deaths per year.  
7 In addition mosquito-borne illnesses are estimated to be  
8 transmitted to more than 700 million people annually.  
9 In some parts of Africa it is estimated that 10% of the  
10 total mortality of infants under the age of 5 is due  
11 directly to the disease. Although historically this  
12 serious illness was localised in tropical areas such as  
13 Central and South America, the Middle East, the Indian  
14 sub-continent and Asia, the prevalence of malaria is  
15 rising due to temporary migration of the population  
16 between these countries, primarily due to the increase in  
17 popularity of tropical destinations for holidays and  
18 vacations. This is exemplified in the UK, where the  
19 number of reported cases of malaria has increased  
20 dramatically in recent decades due to foreign travel.  
21 Although malaria can be cured with prescription drugs,  
22 many mosquito species have developed resistance to common  
23 anti-malarial drugs. Therefore, as with many insect  
24 borne illnesses, prophylaxis is seen as preferable to  
25 cure. This is generally achieved through a combination  
26 of vaccination and also by the prevention of bites in the  
27 first instance.

28

29 Other diseases spread by insects, include the viral  
30 illnesses Yellow Fever, Dengue Fever, Encephalitis and  
31 Filiariasis which are all mosquito-borne. For the  
32 majority of these illnesses there are no preventative  
33 vaccines, and often no specific treatment. Thus the

1 essence of prevention is to avoid being bitten in the  
2 first place and protection from arthropod bites is  
3 paramount in ensuring a reduction in insect-borne  
4 disease. For example at present there is no effective  
5 drug treatment for Yellow Fever or Encephalitis, and  
6 therefore prophylaxis is essential. Yet further, there  
7 is no current effective vaccination for Dengue Fever, and  
8 therefore it is vitally important that the initial insect  
9 bite is avoided.

10

11 Other insect-borne diseases include leishmaniasis which  
12 is transmitted by sandflies; sleeping sickness  
13 transmitted by the tsetse fly; lyme disease and typhus  
14 fever which are transmitted by ticks.

15

16 The demand for suitable insect repellents is therefore at  
17 an all-time high. There are many well known insect  
18 repellents on the market. Historically, most include the  
19 chemical DEET (N,N diethyl-3-methylbenzamide) or DEET  
20 derivatives. The efficacy of DEET in repelling biting  
21 insects has so far not been matched by any other natural  
22 or synthetic product since being introduced in 1975. It  
23 is estimated that 38% of the American population, and  
24 over 200 million people worldwide, use DEET preparations  
25 every year. However, whilst this chemical has been  
26 proven to be highly effective in repelling insects, it is  
27 highly toxic and can be absorbed through the skin. The  
28 toxicity, due to the pharmacokinetics of the chemical,  
29 has resulted in a catalogue of reported minor to serious  
30 adverse effects in use. Heavy exposure to the chemical  
31 is known to induce memory loss, weakness, headache,  
32 fatigue, muscle and joint pain tremors and shortness of  
33 breath. Yet further, DEET can act as a skin irritant and

1 has a disagreeable odour. In addition, care must be  
2 taken to avoid furnishings, plastic, varnished and  
3 painted surfaces, when using repellents containing this  
4 chemical. Accordingly, in recent years there has been a  
5 move towards the search for natural, non-toxic yeast  
6 effective insect repellents, which do not cause  
7 irritation or toxicity to the user.

8

9 It is an object of the present invention to provide a  
10 natural insect repellent, which is non-toxic to the user.

11

12 Yet further, it is an object of the present invention to  
13 provide a natural insect repellent, which is non-irritant  
14 and has a pleasant smell.

15

16 It is a further aim of the present invention to provide  
17 an insect repellent, which is effective against insects  
18 such as fleas, ticks, gnats and, in particular, midges  
19 and mosquitoes.

20

21 According to a first aspect of the present invention,  
22 there is provided a composition, which is effective in  
23 repelling insects, comprising a mixture of essential oils  
24 in a carrier oil.

25

26 Preferably the essential oils are lime oil, myrtle,  
27 citronella oil, eucalyptus oil and neem oil.

28

29 In a preferred embodiment, the carrier oil is grape seed  
30 oil. However, other carrier oils may be used, including  
31 almond oil, avocado oil, vegetable oil, wheat flour oil  
32 or sunflower oil, soya oil or a mixture thereof.

33

1 Preferably the carrier oil constitutes in the region of  
2 50% of the composition.

3

4 Preferably the essential oils constitutes in the region  
5 of 50% of the composition.

6

7 Preferably the neem oil is present in a concentration of  
8 between 740 and 760 drops per 37ml of the composition.

9

10 Most preferably the neem oil is present in a  
11 concentration of 750 drops per 37 ml of the composition.

12

13 Most preferably the myrtle is bog myrtle.

14

15 The neem oil may be in the form of an extract of the  
16 Indian Neem tree *Azadirachta Indica*.

17

18 Preferably the lime oil is present in a concentration of  
19 between 8 and 12 drops per  $\frac{1}{2}$ ml of the composition.

20

21 Most preferably the lime oil is present in a  
22 concentration of 10 drops per  $\frac{1}{2}$  ml of the composition.

23

24 Preferably the myrtle oil is present in a concentration  
25 of between 28 and 32 drops per  $1\frac{1}{2}$ ml of the composition.

26

27 Most preferably the myrtle oil is present in a  
28 concentration of 30 drops per  $1\frac{1}{2}$  ml of the composition.

29

30 Preferably the citronella oil is present in a  
31 concentration of between 190 and 210 drops per 10ml of  
32 the composition.

33

1 Most preferably the citronella oil is present in a  
2 concentration of 200 drops per 10 ml of the composition.

3

4 Preferably the eucalyptus oil is present in a  
5 concentration of 3 to 7 drops per  $\frac{1}{4}$  ml of the composition.

6

7 Most preferably the eucalyptus oil is present in a  
8 concentration of 5 drops per  $\frac{1}{4}$  ml of the composition.

9

10 Optionally the composition is provided as a spray.

11

12 The composition is intended for topical use.

13

14 The composition is suitable for use on humans and  
15 animals.

16

17 The composition repels insects including, but not limited  
18 to midges, mosquitoes, gnats, ticks, flies and fleas.

19

20 Preferably the composition has a pleasant odour.

21

22 According to a second aspect of the present invention,  
23 there is provided a composition, which is effective in  
24 repelling insects, comprising a mixture of lime oil,  
25 myrtle, citronella oil, eucalyptus oil and neem oil.

26

27 Most preferably the myrtle is bog myrtle.

28

29 Preferably the essential oils constitutes in the region  
30 of 50% of the composition.

31

32 Preferably the lime oil is present in a concentration of  
33 between 8 and 12 drops per  $\frac{1}{4}$  ml of the composition.

1  
2 Most preferably the lime oil is present in a  
3 concentration of 10 drops per  $\frac{1}{2}$  ml of the composition.  
4  
5 Preferably the myrtle oil is present in a concentration  
6 of between 28 and 32 drops per  $1\frac{1}{2}$  ml of the composition.  
7  
8 Most preferably the myrtle oil is present in a  
9 concentration of 30 drops per  $1\frac{1}{2}$  ml of the composition.  
10  
11 Preferably the citronella oil is present in a  
12 concentration of between 190 and 210 drops per 10ml of  
13 the composition.  
14  
15 Most preferably the citronella oil is present in a  
16 concentration of 200 drops per 10 ml of the composition.  
17  
18 Preferably the eucalyptus oil is present in a  
19 concentration of 3 to 7 drops per  $\frac{1}{2}$  ml of the composition.  
20  
21 Most preferably the eucalyptus oil is present in a  
22 concentration of 5 drops per  $\frac{1}{2}$  ml of the composition.  
23  
24 The neem oil comprises the remainder of the composition  
25 and acts as a carrier oil.  
26  
27 Optionally the composition is provided as a spray.  
28  
29 The composition is intended for topical use.  
30  
31 The composition repels insects including, but not limited  
32 to midges, mosquitoes, gnats, ticks, flies and fleas.  
33

1 Preferably the composition has a pleasant odour.

2

3 According to the third aspect of the present invention,  
4 there is provided a composition, which is effective in  
5 repelling insects, comprising a mixture of essential oils  
6 and a base cream.

7

8 Preferably the essential oils are lime oil, myrtle,  
9 citronella oil, eucalyptus oil and neem oil.

10

11 Most preferably the myrtle is bog myrtle.

12

13 Optionally the composition comprises a carrier oil which  
14 may be grape seed oil, however other carrier oils may be  
15 used, including almond oil, avocado oil, vegetable oil,  
16 wheat flour oil or sunflower oil, soya oil or a mixture  
17 thereof.

18

19 Typically the base cream comprises a mixture of aqua,  
20 prunus dulcis, glycerine (vegetable), cetearyl alcohol,  
21 stearic acid, triethanolamine, ceteareth 20, methyl  
22 paraffin, imidazolidinyl urea and propyl paraffin.

23

24 The composition is intended for topical use.

25

26 Preferably the composition has a pleasant odour.

27

28 Advantageously, the described composition has an  
29 agreeable smell, and is completely natural and non-toxic  
30 to the user.

31

32 In the present invention, it has been discovered that the  
33 described composition has surprisingly superior and

1 super-additive effectiveness over conventional insect  
2 repellents in repelling midges and mosquitoes.  
3 Specifically, it has been discovered that by preparing a  
4 composition comprising 10 drops per  $\frac{1}{2}$  ml of lime oil, 30  
5 drops per  $1\frac{1}{2}$  ml of bog myrtle, 200 drops per 10 ml of  
6 citronella oil, 5 drops per  $\frac{1}{4}$  ml of eucalyptus oil and  
7 740 drops per 37 ml of neem oil, preferably with a  
8 carrier oil results in a superior non-toxic insect  
9 repellent.

10

11 It is well known in the field of aromatherapy to refer to  
12 quantities of essential oils in the form of "drops per  
13 ml". Generally 20 drops is equivalent to 1ml of  
14 essential oil, although the important concept is the  
15 quantity of the essential oil relative to the carrier  
16 oil, or other oils, as opposed to the exact quantity  
17 used.

18

19 In the preferred embodiment, grape seed oil is used as a  
20 carrier, however it will be appreciated that any suitable  
21 natural oil, such as almond oil, avocado oil, vegetable  
22 oil, wheat flour oil or sunflower oil, soya oil or indeed  
23 a mixture thereof could be used.

24

25 It is also appreciated that any form of eucalyptus, such  
26 as lavender eucalyptus or lemon eucalyptus could be used  
27 within the composition. Similarly, whilst the use of bog  
28 myrtle is preferred, any alternative and corresponding  
29 type of myrtle, such as white myrtle, could be used.

30

31 In an alternative embodiment, the carrier oil could be  
32 removed altogether, and the neem oil could be substituted  
33 as the carrier base.

1

2 The composition can be provided in the form of a spray or  
3 a topical cream or ointment.

4

5 The effectiveness of the composition described in the  
6 present Application has been tested in the laboratory.  
7 Comparative tests were carried out with 14 volunteers  
8 using an arm in cage technique with adult laboratory  
9 reared Aedes Aegypti (Cucilidau) insects. In this  
10 technique an area of skin (in this case the hand/arm) is  
11 coated with the composition being tested and then exposed  
12 to the insects (typically around 20 insects) within an  
13 enclosure for a set, standard period of time. The  
14 enclosures were thick plastic cylinders with a resealable  
15 opening at one end, into which a volunteers hand could be  
16 placed. All areas of the enclosure where viewable from  
17 the outside. The insects used, were chosen primarily due  
18 to their prevalence in tropical and subtropical regions.  
19 The species is a notorious insect vector. In addition  
20 this species is relatively large in size which  
21 facilitated observation regarding their movement and  
22 behavioural response to the various repellents during the  
23 tests. Effectiveness was calculated by two means,  
24 firstly by visual observation of the number of mosquitoes  
25 which land on the tester's hands, and secondly by  
26 counting of the number of visible bites which appear at  
27 the end of the test.

28

29 The volunteers were selected to representative of varying  
30 age groups and consisted of 6 males and 8 females.  
31 Repellency was calculated by measuring the landing rates  
32 of the insects. Specifically the percentage decline of  
33 mosquitoes landing within a predetermined area of skin

1 was used as a measure of repellency efficacy. Each  
2 volunteer first undertook a control test by placing their  
3 untreated arm into the enclosure containing a mixed  
4 population of the mosquitoes. Both left and right hands  
5 were used. The volunteers wore protective gloves with a  
6 4 X 6 cm square cut away, to serve as an assessment area.  
7 The assessment area could be easily viewed through the  
8 enclosure. The landing rate of the mosquitoes, and  
9 behaviour, was observed for a period of 5 minutes.  
10 Following the control test, one of the compositions being  
11 tested was applied to the exposed area of skin and  
12 allowed to dry for 10 minutes, as all products tested  
13 were aqueous solutions, and thus a period was required to  
14 allow the composition to dry on the skin. The procedure  
15 was then repeated for the treated hand.

16

17 Five commercially available repellents were compared to  
18 the composition of the present invention. Two of the  
19 five were synthetic DEET based products. The third  
20 repellent contained the active ingredient of citronella,  
21 in order to allow comparison of the repellency of the  
22 composition of the present Application with citronella.  
23 The fourth repellent was neem based, with concentrated  
24 solutions of eucalyptus, bergamot and rosemary, and  
25 allowed comparison of the repellency of the composition  
26 of the present Application with neem oil. A fifth  
27 product, a cosmetic moisturiser containing citronella was  
28 also tested.

29

30 Figure 1 illustrates the comparative efficacy of the  
31 compositions tested. Percentage repellency was  
32 calculated using:

33

1            100 - no of bites on treated hand X 100  
2            no of bites on control hand

4 As expected the two DEET based treatments showed the  
5 greatest repellency. However whilst these products have  
6 excellent repellency (inducing on average 84.7% and 84.6%  
7 reduction in mosquito landings) the disadvantages of  
8 these products (toxicity, high skin absorption,  
9 unpleasant smell are well documented.

10

The fifth repellent (neem based, with concentrated extracts of eucalyptus, bergamot and rosemary) provided the least protection from mosquito landing and in some cases failed to reduce landing rates at all. The fourth repellent, a cosmetic moisturiser reputed to have repellent properties and containing citronella, provided more protection (an average of 57.6% reduction) but was short-lived, and it is thought that the mosquitoes were temporarily repelled by the perfume component of this product. The third citronella based repellent was more effective, providing a 62% reduction in mosquito landings. However in the tests the composition of the present Application induced the closest effects to the DEET products - reducing mosquito landings by 70.6% - an additional 30% over the Neem oil based product (repellent No 5). Accordingly the composition of the present Application, which consists of a combination of essential oils, has a surprisingly synergistic effect over existing commercially available products containing these essential oils.

31

32 In addition to counting the number of landings/bites,  
33 observations of the behavioural changes in the test

1 mosquitoes were made. This was done in order to  
2 determine where any of the compositions being tested  
3 modified or inhibited the normal mosquito behaviour.

4

5 When exposed to the DEET based repellents a dramatic  
6 change was observed in the mosquito behaviour - namely  
7 that activity levels fell greatly. Flight activity was  
8 reduced and many of the mosquitoes were observed to rest  
9 on the surface of the enclosure. In addition the  
10 mosquitoes displayed excessive cleaning, in some cases  
11 frantic cleaning of the antenna, and extensive cleaning  
12 of the proboscis, wings and appendages. This behavioural  
13 response was noticed most in male mosquitoes. These  
14 behavioural responses were not observed when the  
15 remaining three commercially available, and natural based  
16 compositions were tested, i.e. the citronella based  
17 repellent, cosmetic citronella based moisturiser, and the  
18 neem oil with extracts of eucalyptus, rosemary and  
19 bergamot) based repellent.

20

21 However, when tested, and surprisingly, the composition  
22 of the present invention elicited the same behavioural  
23 responses as the DEET products - i.e. inactivity and  
24 excessive cleaning. In addition the mosquitoes displayed  
25 irregular body movements and incoordination - many of the  
26 mosquitoes showed inability to retain grip on the  
27 enclosure walls. This was surprising as behavioural  
28 changes were not observed with the three natural based  
29 commercially available repellents. Prior to testing it  
30 was expected that behaviour of the insects when exposed  
31 to the composition of the present invention would be  
32 closer to the behaviour elicited by these other natural  
33 repellents, and not, as actually occurred in the testing,

1 the synthetic DEET products. It has been postulated that  
2 the observed inability to co-ordinate movement is a  
3 result of highly oxidised azadirachtin molecules (the  
4 active ingredient of the neem oil in the present  
5 composition) targeting the nervous system of the insects  
6 and disrupting ganglier processes. Nevertheless these  
7 behavioural changes were not observed with the  
8 commercially available neem based product. These results  
9 suggest the composition of the present invention is  
10 substantially more effective at curtailing insect or  
11 mosquito attack than existing natural products, as it  
12 induces a lack of activity and incoordination in the  
13 mosquitoes, thus preventing biting, in a similar manner  
14 to synthetic DEET based repellents.

15

16 After exposure to the composition of the present  
17 invention, the alteration in the mosquitoes behaviour was  
18 observed to last for many hours. However after 24 hours  
19 all symptoms had disappeared, leaving no apparent lasting  
20 damage to the insects.

21

22 The composition herein described has been shown to have a  
23 substantially greater efficacy at repelling insects than  
24 existing commercially available natural oil based  
25 repellents. In particular the composition which consists  
26 of a mixture of lime oil, myrtle, citronella oil,  
27 eucalyptus oil and neem oil, has been shown to have a  
28 surprisingly greater efficacy at repelling insects than  
29 commercially available citronella or neem based  
30 repellents. The composition of the present invention,  
31 has an efficacy close to synthetic DEET products and  
32 elicits a behavioural response in mosquitoes very similar  
33 to DEET, but which is not produced by existing natural

1 oil based repellents. Although the present composition  
2 has been shown to have a similar efficacy to DEET, it has  
3 inherent advantages over this synthetic repellent, as it  
4 has no toxic side-effects, and has a pleasant smell.

5

6 Modifications and improvements may be made to the  
7 foregoing without departing from the scope of the  
8 invention.